

REMARKS

In the last Office Action, the Examiner repeated and restated the restriction requirement and held claims 19-25 as being directed to the elected invention and claims 26-53 as being drawn to non-elected inventions.

Claims 19 and 22-25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Masahiro et al. (Japan 09-127139) ("Masahiro") in view of Hantschel et al. (U.S. Patent No. 6,668,628) ("Hantschel"). Claims 20 and 21 were objected to as being dependent upon a rejected base claim and were otherwise indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants and applicants' attorney acknowledge with appreciation the indication of allowable subject matter concerning claims 20 and 21. However, for the reasons explained below, applicants respectfully submit that in addition to claims 20 and 21, claims 22-25 and newly added claims 54-76 are also patentable over the prior art.

In accordance with this response, allowable dependent claims 20 and 21 have each been rewritten to independent form and, in addition, have been revised in minor respects to better define the invention. For the reasons noted by the Examiner, independent claims 20 and 21 are now believed to be in allowable form.

Dependent claims 22, 23 and 25 have been amended to depend on claim 20 rather than canceled claim 19. In addition, claim 22 has been amended to improve the wording. Dependent claims 22-25 each depend on allowable claim 20 and are therefore likewise allowable.

New claims 54-76 have been added to provide a fuller scope of coverage. The specification has been amended in minor respects to make editorial revisions.

New claims 54-70 are directed to an embodiment which, in its broadest form, is shown in Figs. 1-2, and claims 70-76 are directed to another embodiment, which is shown in its broadest form in Figs. 3-4.

Independent claim 54 is directed to a method of manufacturing a multi-tip probe comprising the steps of providing a cantilever 1 having a distal end portion on which is formed a conductive film 4, and dividing the conductive film 4 into a plurality of electrodes 6 by sputter etching or gas-assisted etching of the conductive film using a focused charged particle beam to thereby form a multi-tip probe. Neither Masahiro nor Hantschel disclose or suggest such a method.

Masahiro discloses a method of manufacturing a cantilever-type probe by continuously irradiating the distal end of a cantilever 2 with a low energy focused ion beam under vacuum conditions to vapor deposit ions of the

focused ion beam directly onto the cantilever to form a needle-like projection or probe 3. There is no disclosure in the reference of forming a conductive film on the distal end portion of the cantilever, and then dividing the conductive film into plural electrodes by sputter etching or gas-assisted etching of the conductive film, as specified in claim 54.

Hantschel discloses methods of manufacturing multi-tip probes by forming a film of spring material on a substrate such that the spring material film has an internal stress gradient normal to the substrate. The spring material film is then etched to form an elongated island of spring material. A fixed end of the spring material island is then masked, and the unmasked portion of the spring material island is released by etching the material under the unmasked portion. The cantilever portion of the released spring material bends away from the substrate due to the internal stress gradient of the spring material film, while the fixed end portion remains secure to the substrate. There is no teaching or suggestion in the reference of dividing a conductive film formed on the distal end portion of a cantilever into a plurality of electrodes by sputter etching or gas-assisted etching of the conductive film using a focused charged particle beam, as required by claim 54.

In accordance with the method of the invention, the electrodes have very close inter-tip distances, on the order

of less than one micron. As described in the specification on pages 2-3, an inter-tip distance of less than one micron is needed to accurately conduct surface analysis of currently manufactured semiconductor devices. The method of the present invention enables the manufacture of microscopic multi-tip probes having an inter-tip distance on a sub-micron order. With respect to this feature, the Examiner refers to column 14, lines 20-25 of Hantschel, which describes inter-tip distances of six microns or less. However, "six microns or less" is not a disclosure of an inter-tip distance of less than one micron and Hantschel, therefore, does not disclose this limitation.

From the foregoing, it can be seen that the combined teachings of Masahiro and Hantschel do not disclose or suggest the method recited in independent claim 54 and thus claim 54 together with dependent claims 55-70 patentably differentiate over the prior art.

Independent claim 71 is directed to a method of manufacturing multi-tip probe comprising the steps of providing a cantilever having a distal end portion, forming a plurality of conductive lead portions extending lengthwise along the cantilever, and forming a plurality of electrodes on a distal end of the cantilever and in contact with respective ones of the conductive lead portions by irradiating the distal end portion of the cantilever with a focused charged particle

beam while directing a source gas toward the distal end portion to thereby form a multi-tip probe. No similar method is disclosed in the prior art.

As discussed above, Masahiro teaches forming a single needle-like probe 3 by vapor-depositing the ions of the focused ion beam onto the distal end of a cantilever. The reference does not teach forming plural conductive lead portions and does not teach forming plural electrodes on the distal end of the cantilever and in contact with respective ones of the conductive lead portions by irradiating the distal end portion of the cantilever with a focused charged particle beam while directing a source gas toward the distal end portion, as required by claim 71.

Similarly, the manufacturing methods disclosed by Hantschel, as described above, are totally different from the method of claim 71. Hantschel does not disclose the separate steps of forming a plurality of conductive lead portions, and forming a plurality of electrodes in contact with the respective lead portions by irradiating the distal end portion of the cantilever with a focused charged particle beam while directing a source gas toward the distal end portion.

Thus independent claim 71 together with dependent claim 72-76 clearly patentably distinguish over the combined teachings of Masahiro and Hantschel.

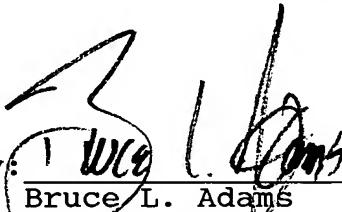


recognized by the Examiner in the statement of reasons for allowability of the subject matter of claims 20 and 21, the prior art does not disclose or suggest the methods recited in claims 20 and 21. Independent claims 54 and 71 are modified versions of claims 20 and 21, respectively, and are similarly patentable over the prior art.

In view of the foregoing, favorable reconsideration together with passage of the application to issue are respectfully requested.

Respectfully submitted,

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March 8, 2005

Date